U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-270 066

In-House Test Program Report No. 1-Vehicle Preconditioning: AMA-1,A-4

Environmental Protection Agency, Ann Arbor, Mich

Jun 76

PB 270 366

Evap. 75-1

Technical Support Report for Regulatory Action

In-House Test Program
Report No. 1
Vehicle Preconditioning:
Addition of US vs LA-4

June 1975

by

Thomas Barlick
Gary M. Wilson

Notice

Technical support reports for regulatory action do not necessarily represent the final EPA decision on regulatory issues. They are intended to present a technical analysis of an issue and recommendations resulting from the assumptions and constraints of that anlysis. Agency policy constraints or data received subsequent to the date of release of this report may alter the conclusions reached. Readers are cautioned to seek the latest analysis from EPA before using the information contained herein.

Standards Development and Support Branch
Emission Control Technology Division
Office of Mobile Source Air Pollution Control
Office of Air and Waste Management
U.S. Environmental Protection Agency

NATIONAL TECHNICAL INFORMATION SERVICE

Reprinted 9-76

1. REPORT NO. EPA-460/3-74-027	2.	3.	4. Publication Accession No.
4. Title and Subtitle: In-House Test Program Report No. 1 Vehicle Preconditioning: AMA-LA-5			5. Report Date: June 1974
7. Author(s): Thomas Garick and Gary M. Wilson			8. Performing Organization Rept. No. EVAP.VT-1
9. Performing Organization Name and Address: Standards Development and Support Branch, Emission Control Technology Division, Office of Mobile Source Air Pollution Control, Ann Arbor, Michigan 48105			10. Project/Task/Work Unit No. 11. Contract/Grant No.
12. Sponsoring Organization Name and Address: Same as above			13. Type of Report & Period Covered: Technical Support Report 14.

15. Supplementary Notes

16. Abstract: The purpose of vehicle preconditioning is to provide a relatively consistent starting base for all vehicles involved in emission testing. This starting base is intended to prepare the vehicle so that it tends to simulate a real-life condition that an average vehicle would normally experience in its day-to-day operation. Five vehicles, representing different engine-fuel tank configurations, were used in evaluating the effect of two vehicle preconditioning driving sequences on diurnal losses (as measured by the SHED technique) and exhaust emissions. One prep cycle was that required by the 1975 FTP, consisting of driving the vehicle over a pre-established road route followed by a dynamometer drive. The other prep cycle consisted of a dynamometer cycle only. Three tests per sequence per vehicle were conducted. The results of this testing supports an earlier EPA study with regard to exhaust emissions.

17. Key Words and Document Analysis. 17a. Descriptors:
Air pollution
Motor vehicles
Exhaust gases
Tests
Evaporation

17b. Identifiers/Open-Ended Terms:
Vehicle preconditioning
Evaporative emissions

17c. COSATI Field/Group

18. Availability Statement: Release Unlimited	19. Security Class (This Report):	21. No. of Pages: 28
	20. Security Class (This Page):	22. Price:

THIS FORM MAY BE REPRODUCED

Contents

Page

1. Introduction 1
2. Summary and Conclusions 2
3. Technical Discussion 4
   3.1 Program Objective 4
   3.2 Program Design 4
   3.3 Facilities and Equipment 4
      3.3.1 Test Vehicles 4
      3.3.2 Test Fuel 5
   3.4 Test Procedures 5
      3.4.1 Vehicle Preconditioning 7
      3.4.2 Evaporative Emission Tests 7
      3.4.3 Exhaust Emission Tests 7
4. Test Results 9
   4.1 Canister Weights 9
   4.2 Evaporative Emissions 10
   4.3 Exhaust Emissions 10
5. Data Analysis 13
6. References 15

Appendices

Appendix A Individual Test Results

I. Introduction

The purpose of vehicle preconditioning is to provide a relatively consistent starting base for all vehicles involved in emission testing. This desired starting base is intended to prepare the vehicle so that it tends to simulate a real-life condition that an average vehicle would normally experience in its day-to-day operation. Two basic conditioning levels are now simulated with the present procedure - the soak-soak, which allows the vehicle to reach a stabilized ambient temperature; and the preconditioning drive, which conditions the evaporative control system (i.e. canister) and flushes out the old fuel. Additionally, this prep drive may standardize the vehicle if it has not been operated within a reasonable length of time.

The preconditioning/vehicle operation described in the Federal Register (1) requires that the test vehicle be driven over a prescribed mileage accumulation route for a period of one hour (this is usually called the AMA road route). The fuel tank is then drained and a specified amount and type of fuel is added. The vehicle is then driven over a simulated trip on a chassis dynamometer (usually called an LA-4). In other words, the premise is that the road segment is conducted to provide controlled, reproducible preconditioning of the evaporative emission storage device. The dynamometer segment is conducted to load the vehicle fuel system with test fuel and to assure a consistent vehicle condition. The natural question that follows, is, Why can't the dynamometer segment provide both?

II. Summary and Conclusion

Five vehicles, representing different engine-fuel tank configurations, were used in evaluating the effect of two vehicle preconditioning driving sequences on diurnal losses (as measured by the SHED technique) and exhaust emissions. One prep cycle was that presently required by the 1975 FTP, consisting of driving the vehicle over a pre-established road route followed by a dynamometer drive (AMA + LA-4). The other prep cycle eliminated the road route and consisted of a dynamometer drive (LA-4) only. Baseline and comparative tests were conducted according to the procedures described in J1711a of the SAE Handbook. Three tests per sequence per vehicle were conducted. The results of this testing supports an earlier EPA study with regard to exhaust emissions (2).

Canister weights were measured throughout the test sequence and although the information is interesting, a chronological plot of weight vs. time does not conclusively show changing or repeatable weight levels. It appears from the observed data however, that the differential weight change of the canister is about the same for either prep cycle. This is particularly noticeable in the Vega evaporative control system where the basic weight of the canister differed for each prep cycle, yet the differential weight change is relatively the same. Apparently the purge rate is such that the canister does not fully purge itself completely

(to normal working capacity) with either prep cycle. It was expected that additional vehicle preconditioning, such as the AMA in addition to the LA-4, would purge the canister to a lower level, thus allowing a greater adsorption capacity for the canister during the diurnal heat-build and thus, reducing the measured amount of diurnal losses. There was no clear evidence of this and statistically it may be stated that no significant difference in diurnal emissions was observed.

If any differences in exhaust emissions were to exist, it was thought they probably would show their greatest influence in bag 1, HC and CO. The average CO level for all test cars was found to be slightly higher in bag 1 for the AMA + LA-4 prep. This difference was mainly influenced by one questionable test on the Chrysler. No significant differences in weighted composite exhaust emissions were detected. This conclusion supports a previous in-house study [2] where each of three vehicles was tested ten times with different prep drives. In this study three preconditioning (AMA + LA-4, one LA-4, four LA-4's) procedures were evaluated in order to determine their subsequent effect on exhaust emissions. The conclusion was, "no evidence of a difference in emissions was found among the three preconditioning procedures." All conclusions related to the testing involved in this test indicated that the premise of substituting the LA-4, only, prep for the AMA + LA-4 prep cannot be rejected, at a reasonable confidence level, on the basis of significant differences in diurnal and exhaust emissions. Therefore, based upon this information and the questionable validity of the AMA as a representative urban driving cycle, and further, the effective reduction in time and manpower requirements, it is recommended that the AMA one hour road route be eliminated as a vehicle preconditioning requirement.

3. Technical Discussion

Generally, a test procedure attempts to typify or simulate an actual condition. In the case of the Urban Dynamometer Driving Sequence (UDDS), concerted effort was expended to establish this sequence as an average driving cycle (3). The AMA road route which is described in the Federal Register and which is used as the mileage accumulation driving schedule is also used as a part of the preconditioning procedure for evaporative emission testing. The inclusion of one hour of AMA driving as a part of the vehicle preconditioning is scarcely justified, if the test is to represent typical vehicle use. Of particular interest in vehicle preconditioning for evaporative determination is the conditioning of the canister. This conditioning is accomplished by purging (or loading, possibly) the canister to its normal working capacity during the prep drive. This allows the canister to accommodate the evaporative losses generated by the subsequent diurnal heat-build. If the UDDS is the typical driving schedule, normal purging or loading of the canister will occur, just as it would occur in actual vehicle use. If more vehicle operation is needed to purge the canister, hydrocarbon adsorbed during the soak periods are probably not described during test periods of vehicle operation. If they are not, then this could possibly create a build-up of hydrocarbons in the canister and a break-through might eventually occur. This could account for a significant degradation of

the quality of ambient air, and yet, would not be accounted for in the actual certification test.

The interrelationship between the generation of evaporative emissions and purge system characteristics determines whether, for any given schedule of events, this hydrocarbon build-up will occur. Conducting some tests with bench purged canisters will establish the basic adequacy of the storage system.

3.1 Program Objective

The purpose of this study was to examine the need for retaining the AMA road route as a prerequisite to dynamometer preconditioning. The objective is to justify the elimination of extraneous vehicle preconditioning and present a more cost-effective test sequence without introducing any adverse effects to the overall simulation of vehicle operation.

3.2 Program Design

This test program was designed to reveal if significant differences existed in diurnal emissions and exhaust emissions when the vehicle underwent different preconditioning drives. It was important to determine that, if significantly different diurnal emissions occurred, such differences could or could not be attributed to the canister purge rate. It was assumed that the LA-4 prep drive would be sufficient to purge the canister to its normal working capacity, and if not, that the reason was due to the canister purge rate design. Five vehicles were used in the prep evaluation test program and underwent identical test procedures. Data obtained during these tests included canister weights and measurements for diurnal and exhaust emissions. Because of studies relating to other items of interest, additional pertinent data were recorded, which are not presented as part of this report, but will be presented in future reports.

To determine the storage adequacy of the test vehicle's canister a controlled diurnal test was conducted. This was accomplished by installing a pre-purged canister just prior to the diurnal heat-build. The canister was bench purged with nitrogen (for one hour) to a nominal operating capacity for each test. The LA-4 prep cycle was used for this evaluation and only diurnal losses were measured.

3.0 Facilities and Equipment

The LDV Evaporative Enclosure as shown in Figures 3-1 and 3-2 was used for all evaporative emission tests. The room is nominally 8 feet high x 10 feet wide x 20 feet long and has a measured volume of 1540 ft³. Calculation of the enclosure volume with a propane injection and recovery test compared within 2% percent. Propane retention tests of 2 and 4 hours were performed periodically and indicated a leakage rate of less than 0.1 g/hr.

Figure 3-1 Evaporative Enclosure (front view)

Figure 3-2 Evaporative Enclosure (rear view)

3.3.1 Test Vehicles

Five 1975 MY vehicles were used in this evaluation. The criteria for selection of the vehicles were that they had accumulated 4000 miles and had been in use for over 30 days. Additional criteria were engine-fuel tank configuration and exhaust control system. Specifics of each vehicle are shown in Table 3-1.

Make	Chevrolet	Chevrolet	Chrysler	AMC	Volkswagen
Model	Vega	Camaro	New Yorker	Matador	Rabbit
VIN	1X17R5U112M63	1Q87R5M112141	1H45F5C112M031	A5A167Y110105	1556080514
Tire/Rim	165-14	825-15	660-15	200-15	17 x 5½
Transmission	4-speed	Automatic	Automatic	Automatic	4-speed
Air Cond.	no	yes	yes	yes	No
Ign. Timing	10° BTDC	8° BTDC	8° BTDC	8° BTDC	12 BTDC
Idle RPM	700	600	750	700	875
Stove	A.I.R.	PB-7615	7870-15	8814-14	0.08 x 15k
Carb. Model	Holley	Rochester	Thrower	Motorcraft	-
Venturis	2	2	4	2	-
Fuel Fowl Size	39.5 cc	72 cc	120 cc		-
Fuel Tank Vol.	16.0 gal	21.0 gal	20.1 gal	24.1 gal	11.9 gal
Inertia Wt.	3750	4000	4000	4000	3500
Base H.P.	9.9	12.8	12.4	12.7	9.8
Emission Sys.	EGR Oxidation Reactor	EGR Oxidation Reactor	EGR Catalytic Reactor (Dual)	EGR-AIR Oxidation Reactor (Dual)	EGR Pump Injection
Evap. Sys.	Canister	Canister	Canister	Canister	Canister

Table 3-1 Test Vehicle Description

3.3.2 Test Fuel

Indolene Type HO (95.0-98.5 octane) test fuel was used throughout the program including vehicle preconditioning.

3.4 Test Procedures

For the comparative tests each of five vehicles underwent identical test sequences. The evaporative tests involved stoppage in the vehicle's preconditioning drive cycle only. The sequence of events associated with this evaluation is shown in Figure 3-1.

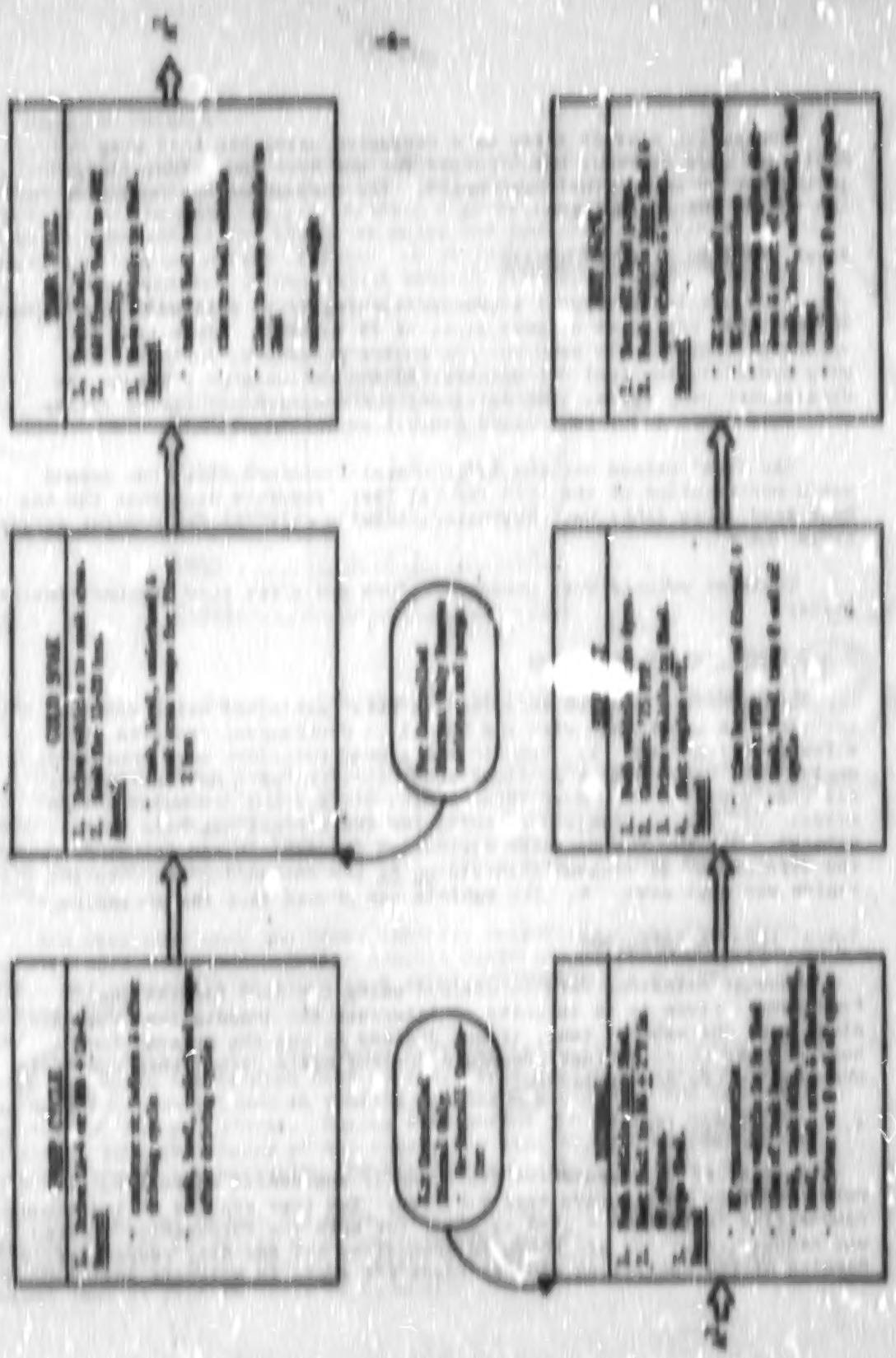


Figure 3-1 Sequence of Events

Controlled diurnal tests were conducted using the LA-4 prep only. Canisters were removed, bench-purged for one hour and reinstalled, just prior to the diurnal heat-build. The evaluation was concluded at the end of the diurnal test.

3.4.1 Vehicle Preconditioning

All vehicles underwent a preconditioning drive followed by an 11 to 30 hour soak period at a temperature of 75 to 86°F. Since test fuel was being continuously used for the entire procedure, including the prep cycle(s), the fuel was not drained and replenished prior to the dynamometer prep cycle. Two different preconditioning driving cycles were used (except for controlled diurnal evaluations).

The first method was the 1975 Federal Procedure (1). The second was a modification of the 1975 Federal Test Procedure such that the one hour road route (AMA) was eliminated, leaving only the dynamometer driving cycle (LA-4).

Canister weights were measured before and after each preconditioning cycle.

3.4.2 Evaporative Emissions

Evaporative emission measurements were determined using the SHED technique in accordance with the SAE J171a Recommended Practice with a few modifications: 1. Vehicle background emissions were considered negligible, based upon a previous study (4), and were not determined. All test vehicles were over three months old and had accumulated 4000 miles. 2. The 60 minute heat-build for the diurnal was held to 4 ± 2 minutes. 3. For the hot-soak evaluation the vehicle was driven off the dynamometer at minimum throttle up to the enclosure, and then the engine was shut down. 4. The vehicle was pushed into the enclosure.

3.4.3 Exhaust Emissions

Exhaust emissions were determined using the 1975 Federal Test Procedure. Since it is intended to integrate the evaporative procedure along with the exhaust test, it was decided to use the present (cold-hot) exhaust emission test procedure driving cycle rather than the cycle proposed in the SAE procedure.

4. Test Results

A total of 33 comparative tests and 17 controlled diurnal tests were conducted on all five test vehicles. The test results of individual comparative tests (AMA + LA-4 vs LA-4) for both the evaporative losses and exhaust emissions are shown in Appendices A-1 and A-2, respectively. Results of the controlled diurnal tests are shown in Appendix A-3.

4.1 Canister Weights

Table 4-1, which extracts data from the Appendix summarizes the average net change in canister weight for each prep cycle. One might expect to see the AMA+LA-4 prep present a greater canister purge opportunity as compared to the LA-4 prep only; and therefore, possibly observing a lighter weight canister, or at least a greater weight change in the canister at the end of vehicle preconditioning. There was no clear indication that this was the case.

Vehicle	Δ Canister Weight (g.) AMA+LA-4	LA-4
Camaro	- 4.7	- 2.0
Matador	+ 0.3	+ 3.3
New Yorker	- 36.7	- 81.3
Vega	- 11.3	- 14.3
Pinto	- 8.7	- 3.7

Table 4-1 Avg. Net Change in Canister Weight From Preconditioning Drive

Figure 4-1 shows the average change in canister weight throughout the vehicle preconditioning and diurnal segments of the test. The run numbers shown in Appendix A-1 were assigned in chronological order. Thus, in the case of the Camaro the AMA+LA-4 preps (Run No's. 0011-0013) were conducted prior to the LA-4 prep evaluation (Run No's. 0014-0017).

The data show that the basic canister weight increased throughout the test series, indicating that vehicle operation prior to the test series had purged the canister to a level well below its nominal working level.

Figure 4-1b for the Vega shows that the basic canister weight level increased about 40g between test series. This weight increase occurred during a three week lapse in vehicle operation which occurred between testing the two procedures. During this period the vehicle was stored outside. Yet, the slopes of the curves are similar, indicating similar weight changes per operation for either prep cycle.

The canister weight for each vehicle throughout the entire test program did not behave in a really consistent manner. The Matador was the only vehicle whose canister weight decreased during the cold soak period (end of prep to start of diurnal).

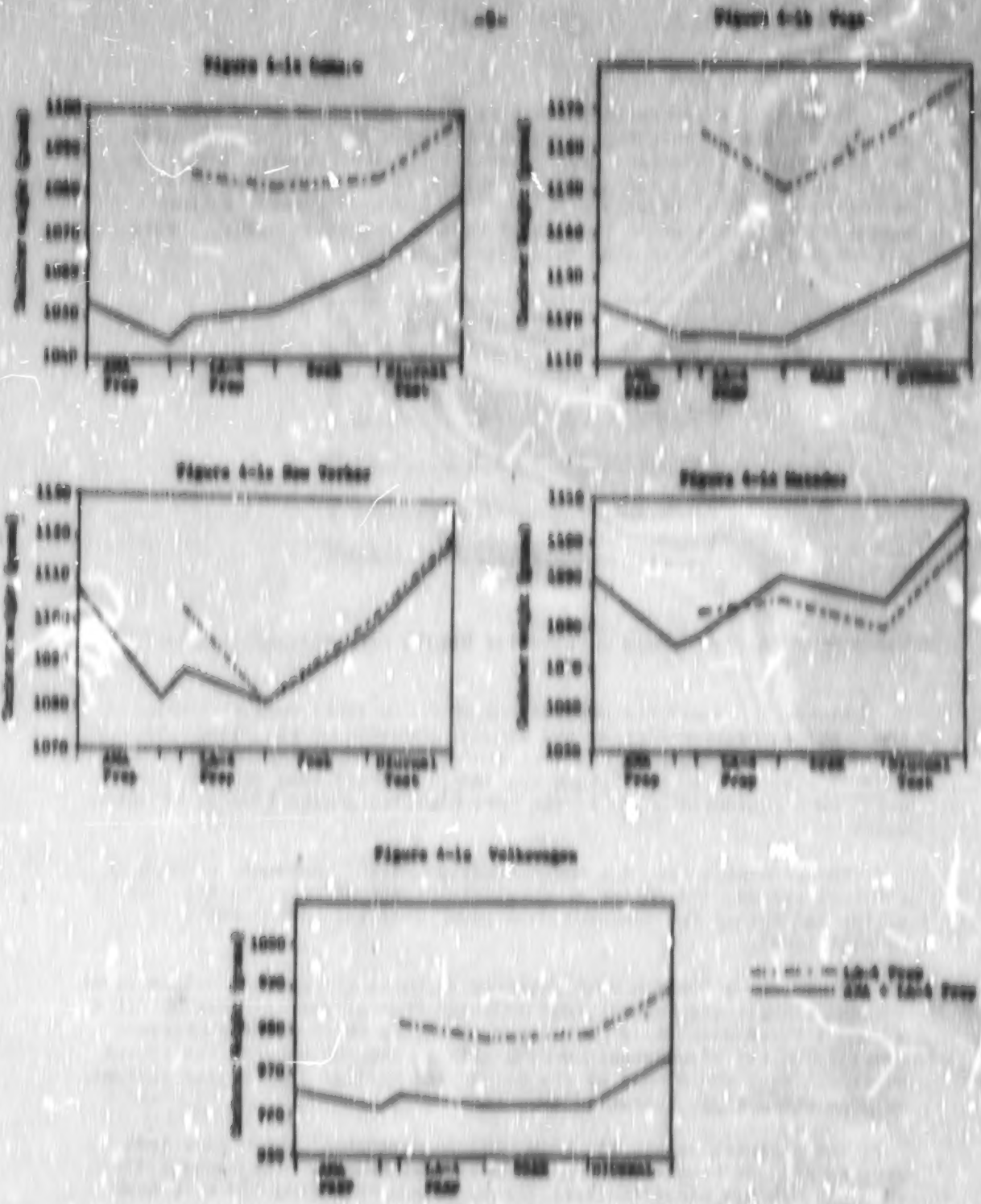


Figure 4-1 Mean Canister Weight Changes for Test Sequence

4.2 Evaporative Diurnal Emissions

The individual test results for evaporative emissions are shown in Appendix A-1 and the means of these data are shown in the bar graph, Figure A-2. The LA-4 prep presented slightly higher diurnal emissions for all vehicles other than the Beetle. Of particular interest shown in the bar graph, is the low level of losses for the controlled diurnal (pre-purged canister installed at start of diurnal test). This indicates that a sufficiently purged canister is capable of holding the entire diurnal losses.

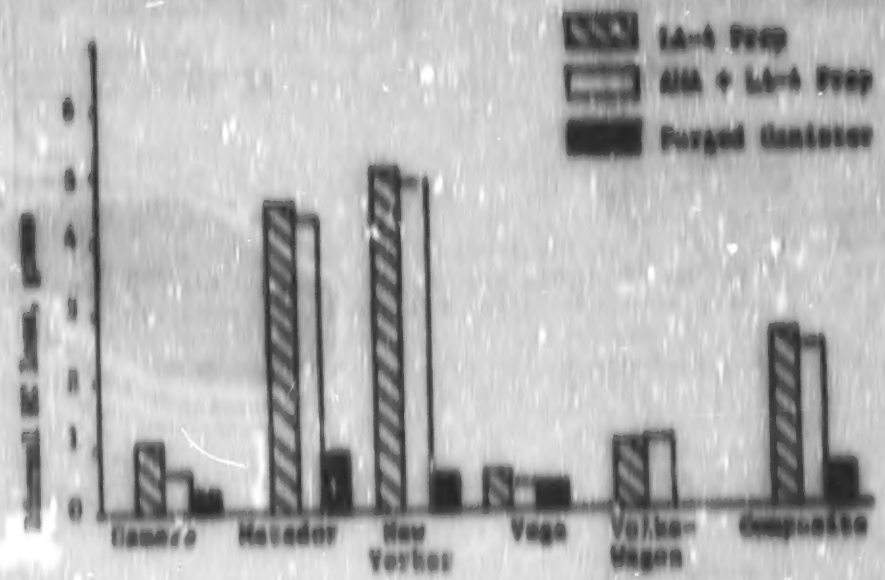


Figure A-2 Mean Diurnal Loss Levels

4.3 Exhaust Emissions

The individual test results for exhaust emissions are shown in Appendix A-2. Figure A-3 shows the mean exhaust emission levels from Bag 1 and Figure A-4 shows the mean composite exhaust emission levels. The over-all average emissions for the vehicle fleet showed little difference in either Bag 1 (Figure A-4) or weighted composite (Figure A-5). Individually, the AMA/LA-4 prep showed significantly higher (30%) emission data in Bag 1 for both the Vega GT and the New Yorker GF. Although used in the determination, test no. 5031 for the New Yorker exhibited unusual results, that on the basis of engineering judgement looked questionable.

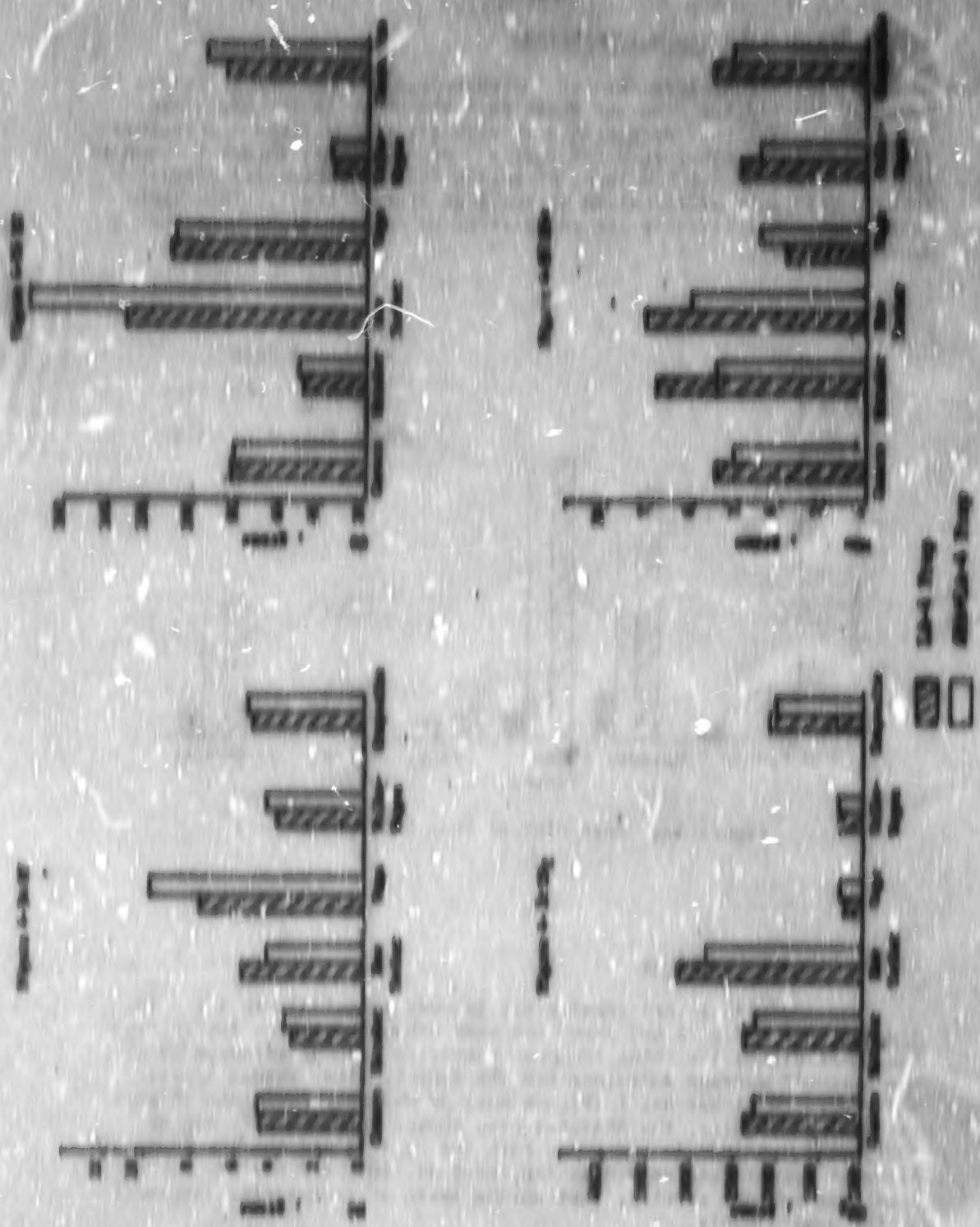


Figure 4-3 Bag 1 Exhaust Emissions

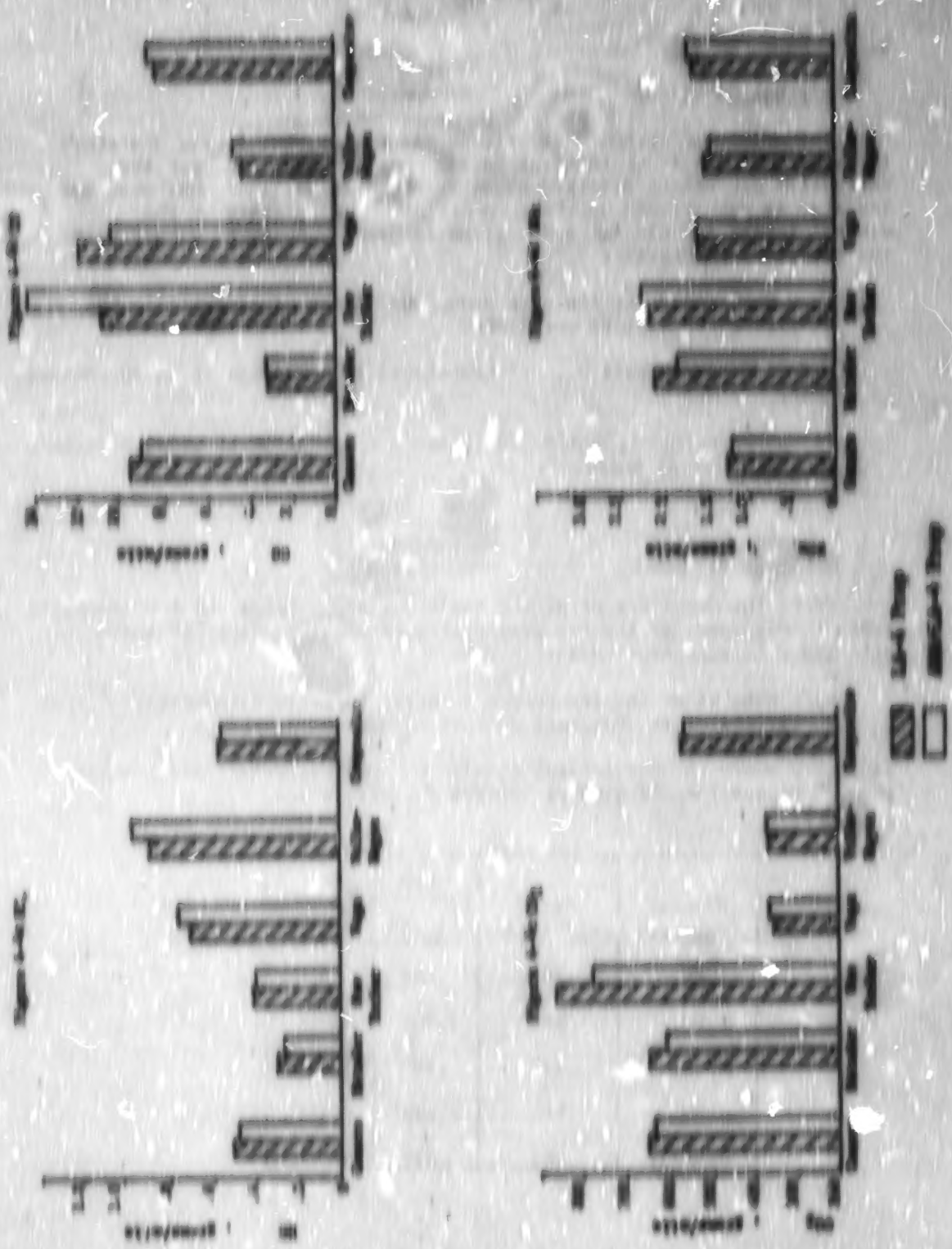


Figure 4-4 Composite Exhaust Antennas

5. Data Analysis

Diurnal Emissions

The means and standard deviations for the diurnal losses are shown in Table 5-1. It is of interest to see that the mean loss for the controlled diurnal (non-purged canister) is over 85% less than when the canister is conditioned by the prep cycles. The analysis of the diurnal losses for the two prep drives is based upon a "t" - test with the following hypothesis:

H_0 = When using the two prep sequences, there is essentially no difference in diurnal emissions.

Under the hypothesis H_0, "t" calculated is 0.103 and it is determined that:

We cannot reject H_0 at $\alpha = .10$ (t-table = 1.697) level of significance for the diurnal emissions.

Exhaust Emissions

Using the developed data, the analysis, shown below, of the composite exhaust emissions for the two prep drives are based upon a "t"-test with the following hypothesis:

H_0 = When using the two prep sequences, there is essentially no difference in composite exhaust emissions.

Table 5-2 shows the statistical results of this analysis. Additionally, the "t" values for the diurnal results are also shown.

Exhaust Components	"t" calculated	"t" table	
		$\alpha = .10$	$\alpha = .05$
HC	.286	1.699	0.054
CO	.650	1.699	0.054
CO_2	.170	1.699	0.054
NO_x	.869	1.699	0.054
Diurnal	.103	1.697	0.054

A "t" test was chosen to determine if a statistically significant difference between the means existed.

Type of Drag	No. of Tests	Mean Coef. (grams)	Standard Deviation	Std. Dev. as % of Mean
AMA + LA-4	8	.84	.06	11
LA-4	8	.81	.03	10
Purged Canister	4	.81	.03	11

Table 5-1a Camaro

Type of Drag	No. of Tests	Mean Coef. (grams)	Standard Deviation	Std. Dev. as % of Mean
AMA + LA-4	8	.80	.05	6
LA-4	8	.81	.10	12
Purged Canister	4	.83	.10	12

Table 5-1b Vega

Type of Drag	No. of Tests	Mean Coef. (grams)	Standard Deviation	Std. Dev. as % of Mean
AMA + LA-4	4	4.0	.07	10
LA-4	4	3.1	1.0	33
Purged Canister	4	.48	.13	26

Table 5-1c New Yorker

Type of Drag	No. of Tests	Mean Coef. (grams)	Standard Deviation	Std. Dev. as % of Mean
AMA + LA-4	3	4.4	1.0	23
LA-4	3	4.3	.66	15
Purged Canister	3	.84	.06	7.1

Table 5-1d Matador

Type of Drag	No. of Tests	Mean Coef. (grams)	Standard Deviation	Std. Dev. as % of Mean
AMA + LA4	3	1.02	.067	6
LA4	3	.947	.101	10
Purged Canister				

Table 5-1e Volkswagen

Type of Drag	No. of Tests	Mean Coef. (grams)	Standard Deviation	Std. Dev as % of Mean
AMA + LA4	10	2.45	2.31	94
LA4	10	2.37	2.08	88
Purged Canister	17	.68	.63	93

Table 5-1f All 3 Vehicles

Table 5-1 Statistical Data for Diurnal Tests.

Statistical summaries of the exhaust emission test results from both test 1 and retained composite emissions are given in Tables D-1 through D-3.

From the "t" - test evaluation above it is determined that:

We cannot reject H_0 at $\alpha = 0.10$ level of significance for the exhaust emission studies.

6. References

1. Federal Register, Vol. 39, No. 133, Section 85.076-12, July 10, 1974.

2. Vehicle Preconditioning Study, EPA-sponsored in-house study conducted by OSAPC Ann Arbor, Michigan.

3. R.H. Braze and T.G. Hale, "Development of the Federal Urban Driving Schedule," Paper 730553 presented at SAE Automotive Engineering Meeting, Detroit, May 1973.

4. E.W. Hurlock and R.W. Thurston, "Measurement of Total Vehicle Emissions", Paper 680125 presented at SAE Annual Meeting, Detroit, Michigan, January 1968.

Vehicle	Type of Prog.	Hydrocarbons (grams/mile)				Carbon Monoxide (grams/mile)			
		N	M	σ	σ/M	N	M	σ	σ/M
Camaro	Modified-4	3	4.15	.97	0.23	3	.67	.09	0.14
Camaro	LA-4	4	4.8	.19	0.04	4	.65	.03	0.05
Vega	Modified-4	3	0.81	1.16	1.43	3	.72	.07	0.10
Vega	LA-4	3	2.23	1.37	1.01	3	.71	.08	0.11
Matador	Modified-4	3	3.7	.83	0.22	3	.58	.04	0.07
Matador	LA-4	3	3.5	.11	0.03	3	.58	.001	0.00
New Yorker	Modified-4	3	4.4	.13	0.03	3	.58	.03	0.05
New Yorker	LA-4	3	3.7	0.0	0.00	3	.60	.00	0.00
Volkswagen	Modified	3	4.65	.48	0.10	3	.57	.008	0.01
Volkswagen	LA-4	3	4.37	.04	0.01	3	.55	.004	0.01
All 4 Vehicles	Modified	12	3.48	0.36	0.10	12	.58	.06	0.10
All 4 Vehicles	LA-4	13	3.58	1.05	0.29	13	.57	.03	0.05

Table 3-3 Statistical data for HC exhaust emissions.

Vehicle	Type of Prog.	Nox (grams/mile)				Humidity (grains/lb)			
		N	M	σ	σ/M	N	M	σ	σ/M
Camaro	Modified-4	3	80	21	0.26	3	8.9	1.8	0.20
Camaro	LA-4	4	84	8.6	0.10	4	9.1	1.8	0.20
Vega	Modified-4	3	100	10.0	0.10	3	10.6	0.7	0.06
Vega	LA-4	3	110	0.65	0.01	3	11.0	0.1	0.01
Matador	Modified-4	3	81	3.8	0.05	3	9.0	.00	0.00
Matador	LA-4	3	69	.07	0.10	3	9.0	.05	0.05
New Yorker	Modified-4	4	170	9.9	0.06	4	14	.83	0.06
New Yorker	LA-4	3	150	97	0.06	3	11	0.5	0.05
Volkswagen	Modified-4	3	30.3	.88	.03	3	6.89	.17	0.03
Volkswagen	LA-4	3	33.0	1.07	03	3	6.88	.00	0.00
All 4 Vehicles	Modified-4	13	96.6	31.0	0.32	13	0.03	0.04	0.13
All 4 Vehicles	LA-4	13	86.9	43.1	0.50	13	0.01	0.09	0.09

Table 3-4 Statistical data for NO exhaust emissions.

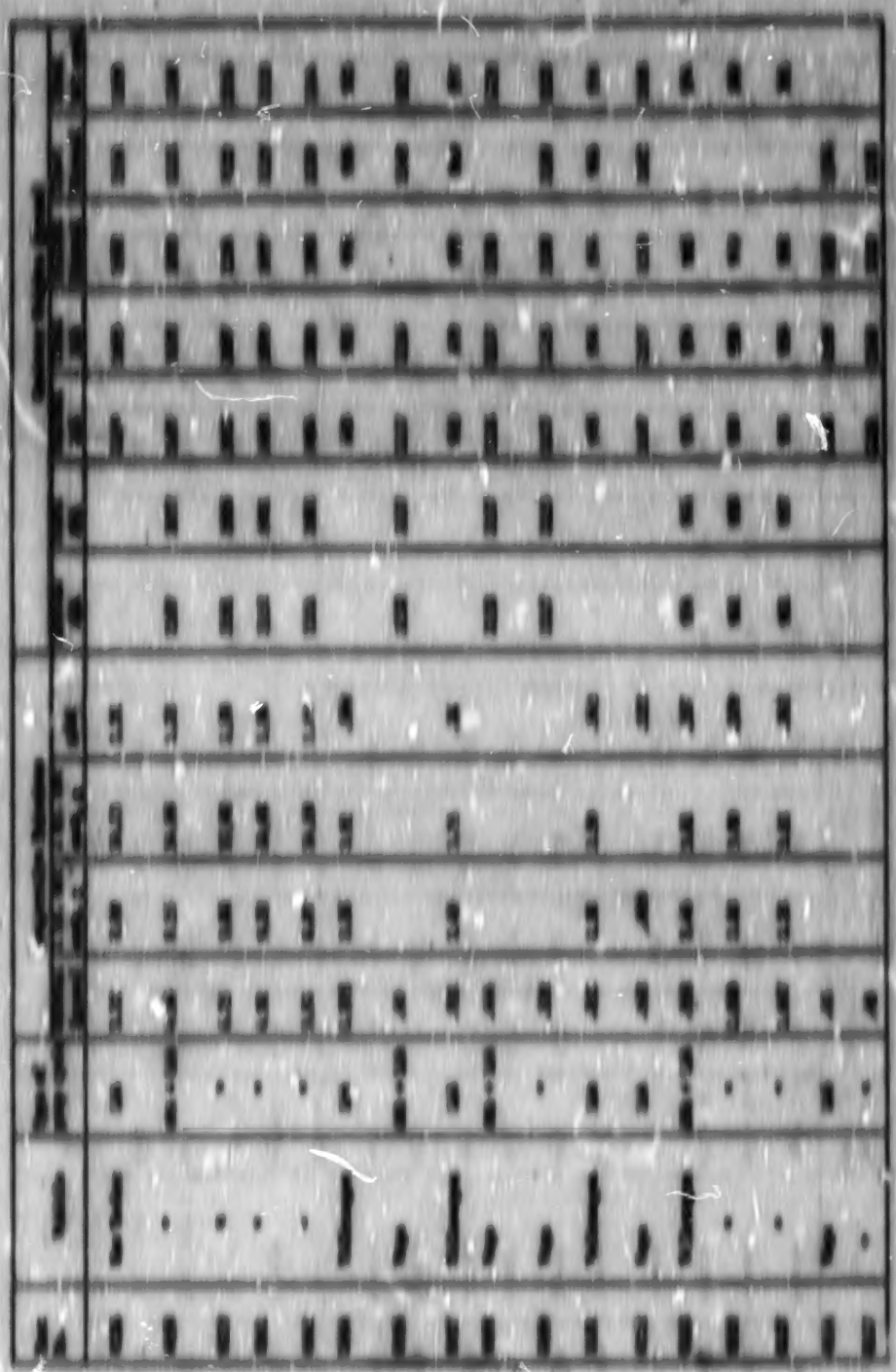
Vehicle	Type of Trip	Trip 1 results (g/mile)				Composite results (g/mile)			
		N	$\bar{x}$	s	s/$\bar{x}$	N	$\bar{x}$	s	s/$\bar{x}$
Camaro	ASM/LA-4	3	1.317	.199	0.15	3	0.33	.08	0.23
Camaro	LA-4	4	0.919	.14	0.15	4	0.43	0.1	0.23
Vega	ASM/LA-4	3	1.001	.08	0.08	3	0.46	0.1	0.21
Vega	LA-4	4	1.005	.16	0.16	3	0.51	0.2	0.39
Monarch	ASM/LA-4	3	1.140	.033	0.03	3	0.53	.01	0.02
Monarch	LA-4	3	0.933	.23	0.25	3	0.61	0.1	0.16
New Yorker	ASM/LA-4	4	0.784	.046	0.06	4	0.34	.04	0.12
New Yorker	LA-4	4	0.868	.110	0.13	3	0.61	.09	0.15
Volkswagen	ASM/LA-4	3	1.054	.13	0.12	3	1.04	0.2	0.19
Volkswagen	LA-4	3	1.036	.08	0.08	3	0.88	0.1	0.08
All 3 Vehicles	ASM/LA-4	14	1.011	.078	.08	14	0.44	.137	.313
All 3 Vehicles	LA-4	15	0.959	.188	.196	14	0.73	.080	.110

Table 5-5 Statistical data for CO$_2$ exhaust emissions.

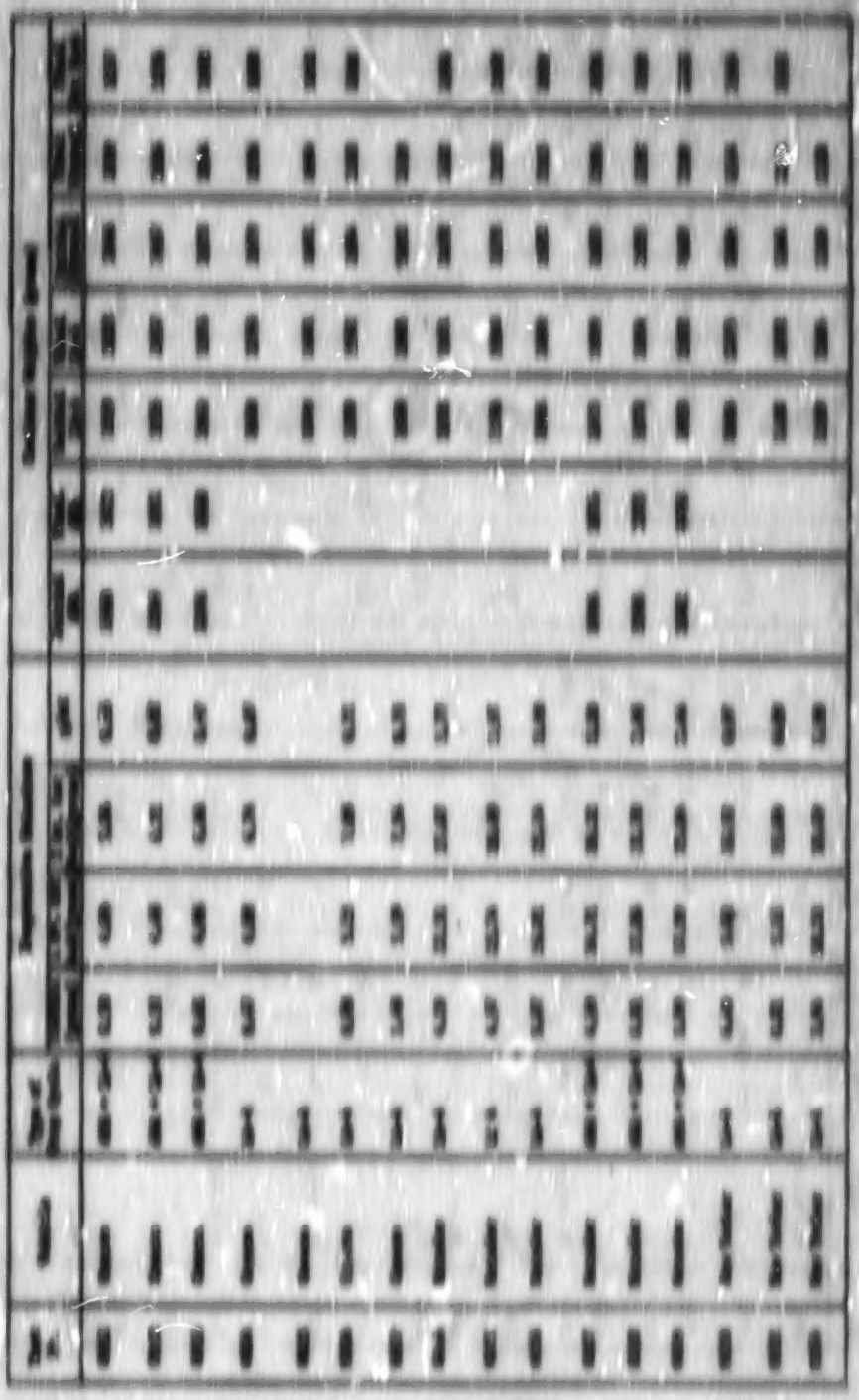
Vehicle	Type of Trip	Trip 1 results (grams/mile)				Composite results (g/mile)			
		N	$\bar{x}$	s	s/$\bar{x}$	N	$\bar{x}$	s	s/$\bar{x}$
Camaro	ASM/LA-4	3	7.1	.43	0.06	3	1.3	.06	0.05
Camaro	LA-4	4	7.5	.49	0.07	4	1.9	.09	0.10
Vega	ASM/LA-4	3	8.18	.70	0.08	3	1.66	.03	0.02
Vega	LA-4	3	8.07	.33	0.04	3	1.35	.06	0.04
Monarch	ASM/LA-4	3	7.5	1.0	0.13	3	1.86	.70	0.38
Monarch	LA-4	3	8.0	.33	0.04	3	2.5	.03	0.01
New Yorker	ASM/LA-4	4	8.0	2.3	0.29	4	2.0	.33	0.16
New Yorker	LA-4	3	9.1	.03	0.03	3	2.3	.49	0.21
Volkswagen	ASM/LA-4	3	8.67	.41	0.05	3	1.67	.003	0.00
Volkswagen	LA-4	3	9.0	.01	0.1	3	1.93	.03	0.02
All 3 Vehicles	ASM/LA-4	13	7.14	1.30	0.18	13	1.78	.48	0.26
All 3 Vehicles	LA-4	13	7.88	1.31	0.17	13	1.88	.48	0.26

Table 5-6 Statistical data for VOC exhaust emissions.

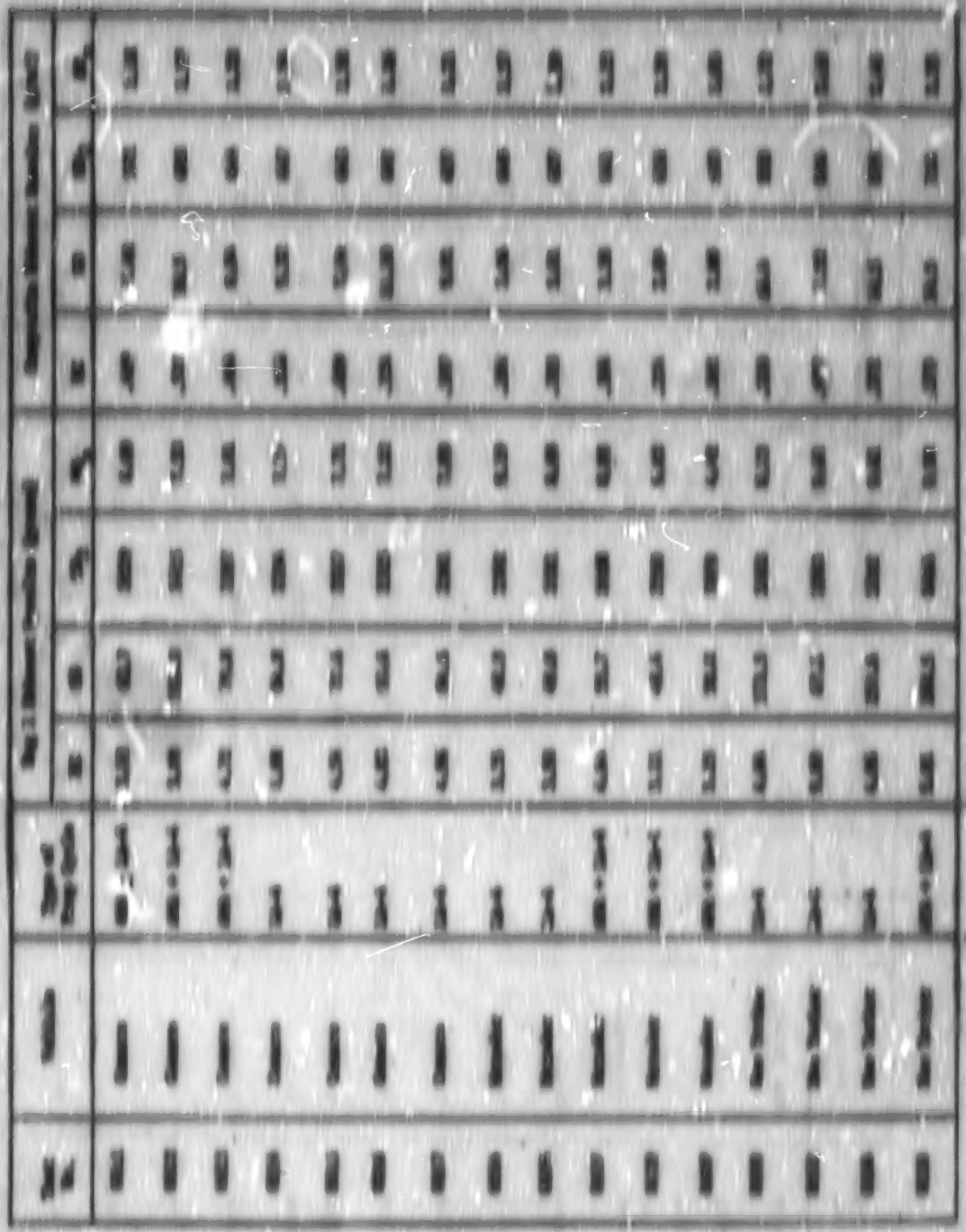
Appendix A-1 (continued)



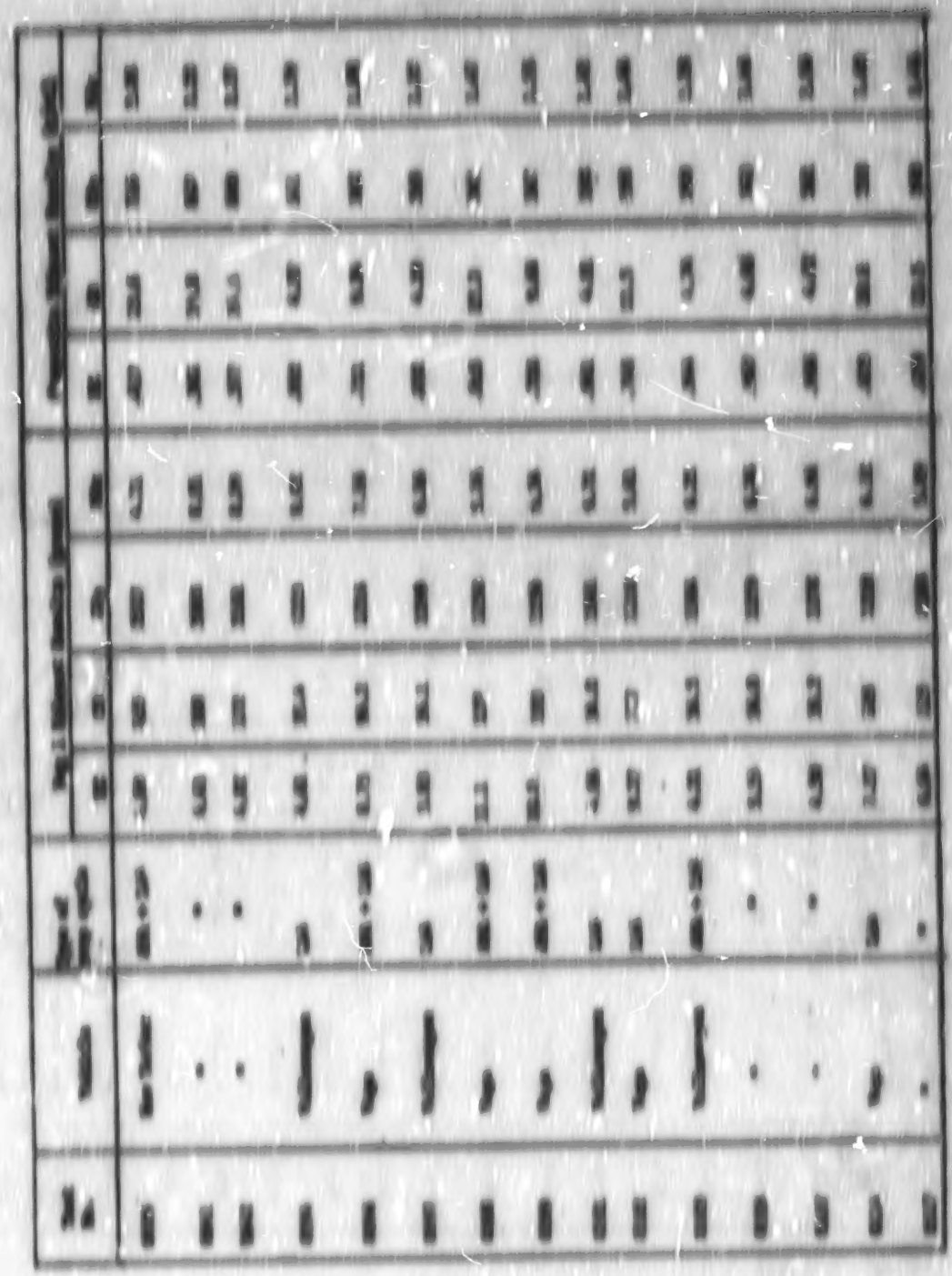
Appendix A-1 Evaporative Emission Canister and Container Weights



Appendix A-1 GTR Behrman Test Results for Bag 1 and Composite Samples



Appendix A-1 (continued)



END

DATE

FILMED

9-28-77

NTIS